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The role of households in the electricity market is becoming increasingly important as we move towards an emission-free energy system powered by intermittent renewable energy sources, such as wind and solar. Demand response, i.e., adjusting consumption in response to electricity prices or other signals, offers an opportunity to help balance the electricity system and shift consumption to times when electricity is readily available. This article examines possible development paths for residential demand response in Finland using the Ansoff matrix, which divides development strategies into four categories: market penetration, market development, product development, and diversification.

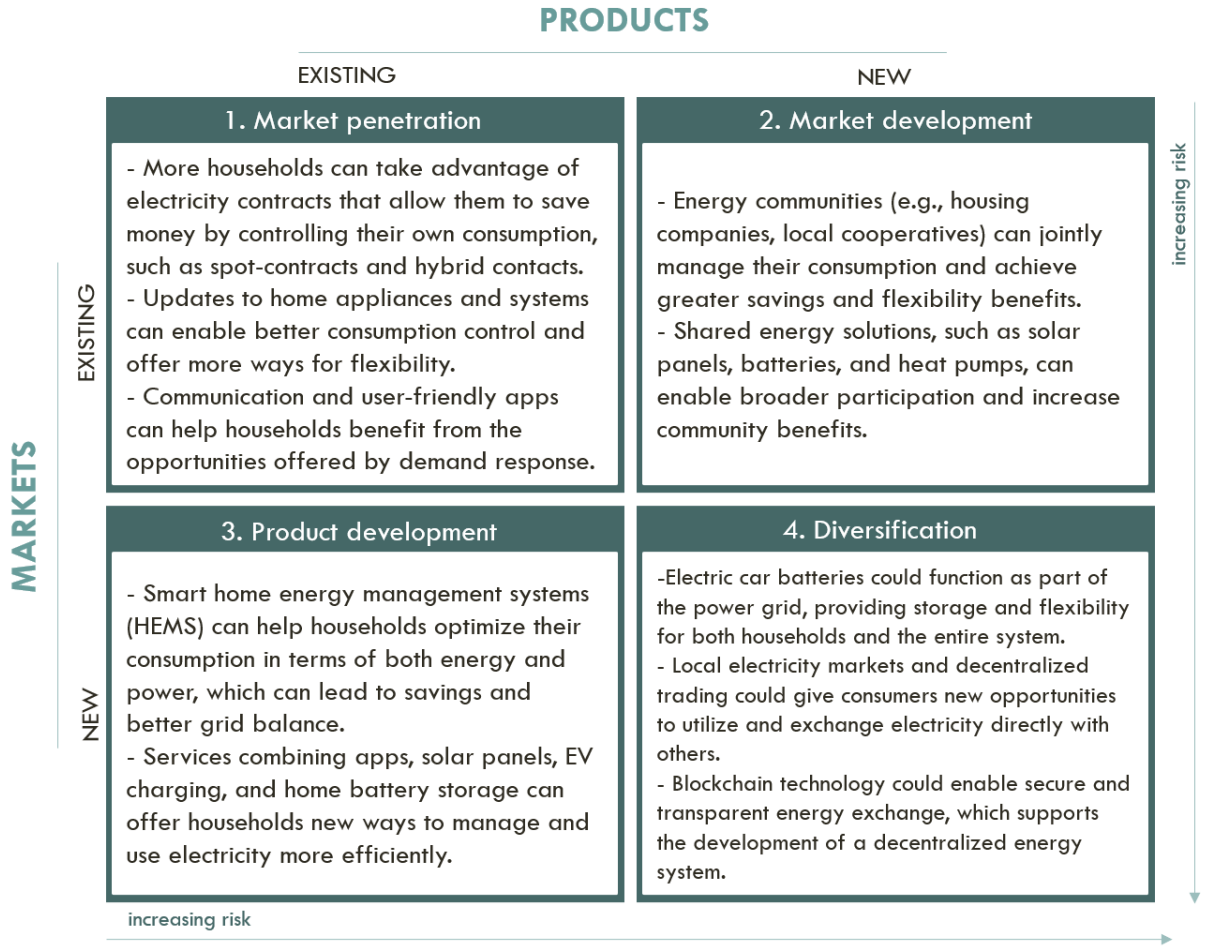

Figure 1. Strategic development paths for residential demand response in Finland. The layout of the matrix follows the commonly used Ansoff matrix [1].

Market penetration

Market penetration refers to increasing the use of existing solutions in current markets. In Finland, this is evident in the growing popularity of spot-based and hybrid electricity contracts, which give households more opportunities to influence their electricity bills by adjusting their consumption habits. For example, the Norwegian company Tibber has been a forerunner in offering a product that combines hourly contracts, smart charging and a user-friendly app for monitoring and optimizing consumption [2]. Similar solutions are also being adopted in Finland by other companies.

The rise of hybrid contracts represents an important development. They combine features of fixed-price and spot-contracts and lower the threshold for adopting demand response, especially for risk-averse consumers. Although hybrid contracts offer clear benefits, their complexity may still slow down adoption.

In addition to new contracts, market penetration also relies on improved consumer engagement and technology upgrades. Communication, user-friendly applications, and device updates can significantly increase adoption and usage among existing customers. For example, software updates for home appliances, such as heat pumps and water heaters, can enable new features, such as remote control, making appliances smarter and easier to control. These added functionalities allow consumers to actively manage their consumption and benefit from flexibility. Clear communication about the advantages of demand response and the potential savings it offers is essential. Applications such as Fingrid's Tuntihinta help consumers monitor the price of electricity, and their Datahub allows consumers to monitor their household's electricity consumption.

A major regulatory change affecting market penetration is the 2025 amendment to the Electricity Market Act, which requires that the load control relays built into smart meters must be opened for market-based demand response [3]. This development comes at a time when the growing number of electricity market-based contracts and the electrification of heating and transport, for example through heat pumps and electric vehicles, are creating new challenges for the electricity system. Optimizing individual devices based solely on the lowest-price hours can lead to power peaks, increasing the need for more comprehensive Home Energy Management System (HEMS) solutions. The new regulation supports this shift by making smart-meter load control relays available for market use, and this capacity is expected to become accessible for market-based demand response by September 2026.

Distribution system operators play a role in this development. Although they operate under a regulated monopoly, they can choose how the allowed revenue is collected. The introduction of power-based pricing shifts costs towards households whose usage places greater strain on the grid [4], encouraging more balanced consumption. This development increases the need for HEMS-type solutions, but it may also reduce the economic benefits of optimization services based solely on hourly prices and therefore

slow the market entry of new demand response providers at a time when household-oriented business models are still emerging.

Market development

Market development refers to, for example, expanding demand response to new customer groups, which significantly increases market potential. A potentially important new target group for demand response is energy communities, such as housing companies, local cooperatives, and other communities that jointly produce, consume, or distribute energy [5]. These communities may have centralised systems and production resources, such as solar panels, battery storage, heat pumps, or shared water heaters. When these devices are centrally controlled, shared equipment allows communities to coordinate their operation, providing greater flexibility to shift electricity use to cheaper periods or to adjust to grid conditions.

Housing companies are a particularly significant example of energy communities. Although the impact of individual residents on the price of electricity is limited, the shared systems of housing companies can be utilised in demand response, which can generate savings for the entire community. In addition, the transition of housing companies from district heating to heat pumps increases electricity consumption. Thereby increasing the importance and potential of demand response for savings and for supporting the electricity system.

Product development

New regulation, the introduction of power-based distribution tariffs, and the accelerating electrification of households are rapidly increasing the requirements for home energy management. Simply controlling individual devices, such as EV chargers or heat pumps, based on hourly prices is no longer sufficient, as scheduling multiple devices to low-price hours can easily create costly power peaks. At the EU level, developments point in the same direction: the Energy Smart Appliances Code of Conduct emphasises interoperability and device-agnostic control to ensure that household loads can be managed holistically across different manufacturer ecosystems. As a result, the role and importance of Home Energy Management Systems (HEMS) are expected to grow significantly. Modern HEMS solutions must be capable of coordinating the entire household load, optimising both energy and power-based costs through real-time data, machine learning, and predictive analytics.

Practical solutions are already emerging. For example, Tibber’s app already integrates smart charging and device control, and similar solutions are being developed by Finnish companies. In the future, comprehensive service models could combine consumer-friendly applications, solar panels, hourly pricing, EV charging, and home battery storage. These solutions would enable households to maximise savings and manage consumption more effectively. Such integrated models would not only enhance

household-level optimisation but also strengthen the business case for HEMS providers by offering bundled services that address both energy and power cost management.

Diversification

Diversification requires both market and product development. One example is V2G (vehicle-to-grid) technology, where an electric car's battery can feed energy back into the grid or into the home during peak pricing periods. Although only a limited number of car models currently support this, the adoption of V2G-compatible vehicles is accelerating.

Completely new solutions also include blockchain-based decentralised energy exchange solutions and local electricity markets. These have already been piloted for example, in Australia [6] and United States [7], where solar and battery systems are controlled to support demand response, and households can exchange renewable electricity with each other. Blockchain technology enables secure and transparent data management, which supports electricity exchange between neighbours without a centralised intermediary. This is especially important in decentralised energy systems, where trust and verification between many small actors are essential.

In addition, consumers and households could participate in reserve markets, which would help to balance the electricity grid during peak demand or unexpected disruptions. Home battery storage, flexible electricity consumption, and small-scale backup generation can provide reserve capacity to the grid. Participation in reserve markets can offer financial benefits to consumers while improving grid reliability.
In the future, such solutions could significantly change the role of households and energy communities in the electricity market in Finland, but large-scale implementation will require technological development, regulatory changes, and consumer readiness to participate.

Summary

Residential demand response may become an important part of Finland's future smart, low-emission electricity system, and progress is taking place along several different paths. These paths can be grouped into four categories based on an Ansoff matrix analysis, paths that lead to: increased use of existing solutions, new customer groups, more comprehensive products, and new innovations. So far, development has progressed particularly in market expansion and product development, while diversification into new customer groups is still in its early stages. Consequently, newer ideas such as energy communities, bidirectional charging of electric vehicles, and local electricity markets still depend heavily on technological development, regulatory changes and consumer willingness to participate.

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